

TABLE 9-continued

List of 11 Transcription Factor Genes Responsive to T1 and T2						
ProbeName	Fold chang	Response to	Comparison	Regulation	Gene Symbol	Description
A_84_P78649 ②	2.35	T1 & T2	T1 vs control	down	WRKY46	WRKY46 (WRKY DNA-binding protein 46); transcription factor [AT2G46400.1]

② indicates text missing or illegible when filed

1.-20. (canceled)

21. A method of improving abiotic stress-response in a plant, the method comprising contacting a part of a seed, a plant, or a locus thereof with an effective amount of a composition of matter, the composition of matter comprising two or more of:

- (a) a mixture of condensed hydrocarbons, lignins, and tannins and/or condensed tannins;
- (b) an oxygen-to-carbon ratio for the dissolved organic matter of greater than about 0.5;
- (c) a total number of tannin compounds greater than about 200, the tannin compounds having a hydrogen to carbon ratio of about 0.5 to about 1.4, and an aromaticity index of less than about 0.7 as measured by mass spectroscopy; or
- (d) a mass distribution of about 55-60% lignin compounds, 27-35% tannin compounds, and about 8-15% condensed hydrocarbon as measured by mass spectroscopy.

22. The method of claim 21, wherein said composition of matter up regulates a receptor of the plant.

23. The method of claim 21, wherein the composition of matter down regulates at least one plant gene selected from the group consisting of WRKY element, an ethylene-responsive element, ABA repressor, salt tolerance zinc finger motif, high light responsive element, a putative disease resistance gene, putative chitinase protein, calcium ion binding proteins, zinc ion binding proteins, phosphate induced protein, ABC transporter family protein, cation/hydrogen exchanger (proton antiporter), glycolipid transporter gene, calmodulin-related protein, protein kinase/sugar binding, protease inhibitor genes, pectinesterase family protein, oxidoreductase, transmembrane receptor gene, heat-shock protein gene, and senescence associated protein.

24. The method of claim 21, wherein said composition of matter up regulates at least one plant gene selected from plant regulator production or response genes, auxin-responsive family protein genes, gibberellin 20 oxidase genes, encoding amino acid transporter genes, carbohydrate transporter genes, purine transporter genes, genes encoding enzymes, defense-related genes, genes encoding transcription factor or transcription regulators, or genes encoding ATPase/ion movement.

25. The method of claim 21, wherein said composition of matter up regulates at least one plant gene selected from genes encoding transcription factors, genes encoding enzymes, genes encoding protein kinases, or genes encoding hydrolases.

26. The method of claim 21, wherein said composition of matter up regulates at least one plant gene selected from plant regulator production or response genes, auxin-responsive family protein genes, gibberellin 20 oxidase genes, encoding amino acid transporter genes, carbohydrate transporter genes, purine transporter genes, genes encoding enzyme, defense-

related genes, genes encoding transcription factor or transcription regulators, or genes encoding ATPase/ion movement; and down regulates at least one plant gene selected from transcription factor genes, transcription regulator genes, growth genes, defense genes, metabolism genes, or ion transport genes.

27. The method of claim 21, wherein the composition of matter comprises a mixture of condensed hydrocarbons, lignins, and tannins and/or condensed tannins, wherein at least 10% of the total % of compounds of the composition are tannins and/or condensed tannins.

28. The method of claim 21, wherein the composition of matter comprises a mixture of condensed hydrocarbons, lignins, and tannins and/or condensed tannins, wherein at least 20% of the total % of compounds of the composition are tannins and/or condensed tannins.

29. The method of claim 21, wherein the improvement in stress reduction comprises improved agronomical recovery of the plant after said stress is reduced or discontinued as compared to a similar plant species not treated with said composition of matter.

30. The method of claim 29, wherein the stress is drought.

31. The method of claim 29, wherein the stress is selected from the group consisting from exposure to salt water, flooding, prolonged darkness, pest herbivory, and temperature variations.

32. The method of claim 29, wherein the improved agronomical recovery comprises at least one of increased plant weight, increased number of leaves, and increased stalk weight after discontinuation of the stress as compared to a similar plant not treated with the composition of matter

33. A method of regulating at least one gene associated with stress response of a plant species, the method comprising contacting a part of a plant or a locus thereof with an effective amount of a composition of matter, the composition of matter comprising two or more of:

- (a) a mixture of condensed hydrocarbons, lignins, and tannins and/or condensed tannins;
- (b) an oxygen-to-carbon ratio for the dissolved organic matter of greater than about 0.5;
- (c) a total number of tannin compounds greater than about 200, the tannin compounds having a hydrogen to carbon ratio of about 0.5 to about 1.4, and an aromaticity index of less than about 0.7 as measured by mass spectroscopy; or
- (d) a mass distribution of about 55-60% lignin compounds, 27-35% tannin compounds, and about 8-15% condensed hydrocarbon as measured by mass spectroscopy; and regulating the at least one gene up or down.

34. The method of claim 33, wherein the at least one gene regulates at least one plant gene selected from genes encoding transcription factors, genes encoding enzymes, genes encoding protein kinases, or genes encoding hydrolases.